

## Stepping on Asbestos Debris

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Key words: Asbestos, scanning electron microscopy, X-ray analysis, dot mapping.

### ABSTRACT

Small pieces of asbestos debris can be released from fireproofing in a building. When stepped on, asbestos fibers without any coating or encasement by gypsum binder are freed and are available to be transferred to other areas of the building. Scanning electron microscope examination with x-ray analysis was used to study the situation.

### INTRODUCTION

Asbestos debris is defined in the Asbestos Hazard Emergency Response Act (AHERA) (1) as pieces of asbestos-containing building material (ACBM) that can be identified by color, texture, or composition. Finding asbestos debris may be an indication of damaged insulation or fireproofing. When pieces of asbestos debris are released into the general working area the

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potential for stepping on them and transferring them to other areas exists.

#### OBSERVATIONS

Several pieces of asbestos debris originating from a fireproofing that had been on the undersiding of decking in a building for approximately 18 years were examined by microscopy. By polarized light microscopy, the pieces were found to contain a mixture of chrysotile asbestos, vermiculite and gypsum.

Examination was also performed by scanning electron microscopy-energy dispersive spectroscopy (SEM-EDS). The SEM/EDS system consisted of a JEOL Model 820 with a Tracor Northern 5402 x-ray system. Many chrysotile bundles and fibers were seen on the surface (Figure 1).

As an experiment to see how the fireproofing debris would be affected by someone stepping on small pieces, a second aggregate was placed into a sealed Zip-loc® plastic bag and crushed by having a volunteer step once on the bag. A small section of the plastic bag that had aggregate material adhering to it was excised and prepared for SEM/EDS analysis by coating it with a thin layer of gold.

Chrysotile fibers were observed among vermiculite and gypsum particles adhering to the inside surface of the bag (Figure 2). At a higher magnification, a large chrysotile fiber can be seen. Its visual appearance (Figure 3) and x-ray analysis done on the fiber showed that it was free of gypsum binder material.

To determine which parts of the crushed debris were coated with gypsum, an x-ray analysis procedure called area dot mapping was used. First an area of the sample was photographed in the normal secondary electron imaging mode (Figure 4). Then as the image area was scanned point by point in a slow raster mode a dot was produced on the photographic image only when there was a calcium x-ray detected at that point on the sample (Figure 5). Although some random dots are imaged, a concentration of dots indicates a gypsum particle. Gypsum is a calcium sulfate. Vermiculite and chrysotile are essentially calcium free. The secondary electron image and the x-ray dot map were combined to form one image (Figure 6) which demonstrated that a chrysotile bundle had only a few particles of gypsum attached. The surface was not coated or encased with gypsum binder material.

J. R. MILLETTE, W. EWING, R. BROWN



Figure 1. SEM micrograph of the surface of asbestos debris released from fireproofing material. Arrow points to a chrysotile bundle. (Bar = 10 µm)

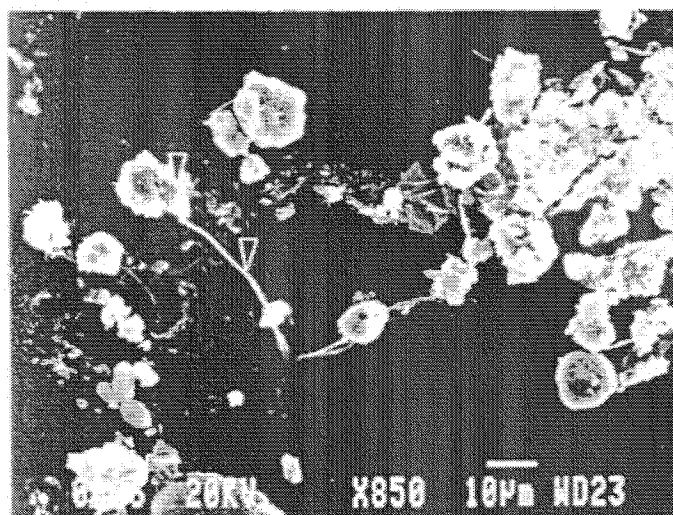


Figure 2. SEM micrograph of asbestos debris material after being crushed under foot. One arrow points to vermiculite particles, the other to a bundle of chrysotile. (Bar = 10µm)

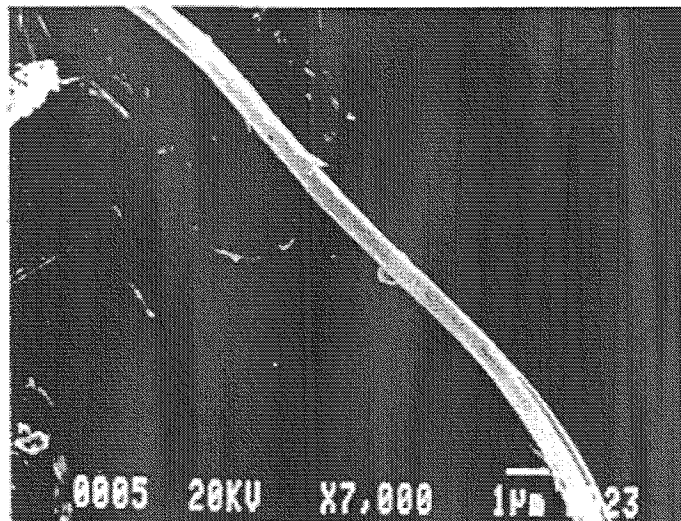


Figure 3. Higher magnification of the chrysotile bundle shown in Figure 2. (Bar = 1 µm)

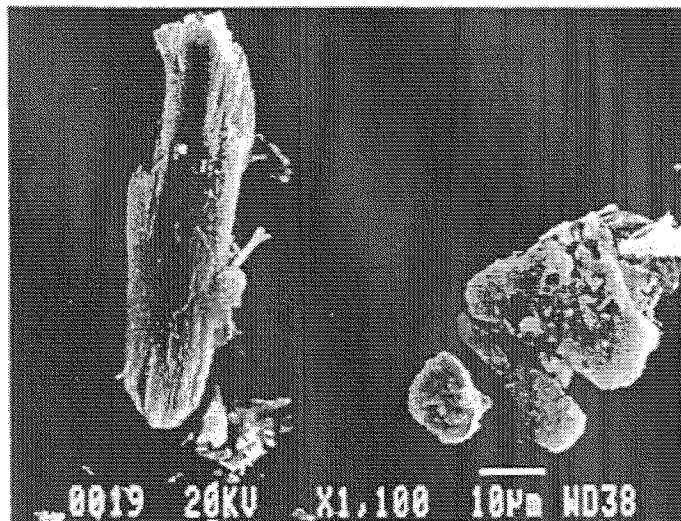


Figure 4. Micrograph showing chrysotile bundle and other material from the asbestos debris particle after being crushed under foot. (Bar = 10 µm)

J.R. MILLETTE, W. EWING, R. BROWN

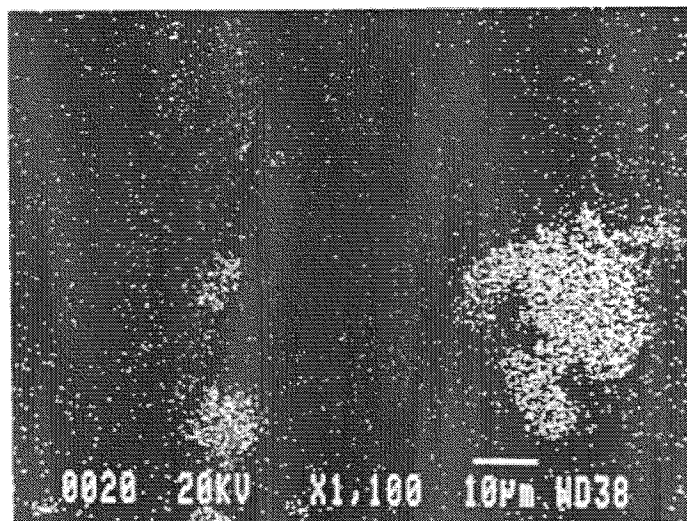


Figure 5. X-ray elemental dot map of area in Figure 4. Dots appear where calcium was detected. Random background dots also appear.

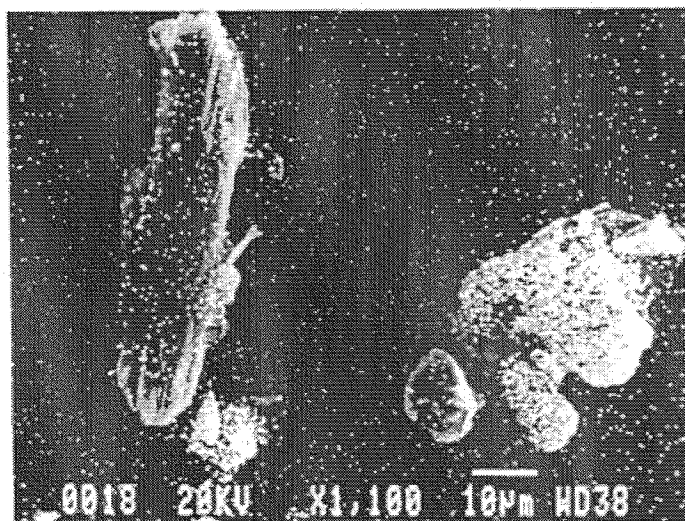


Figure 6. Figures 4 and 5 combined. Gypsum (a calcium sulfate) is present on some parts of the material but not uniformly coating all parts. The chrysotile bundle is not coated.

#### CONCLUSION

The experiment showed that asbestos fibers which were neither coated nor encased in gypsum binder were freed from asbestos debris when the piece of debris was trodden underfoot. A potential for tracking asbestos into other parts of a building and the potential for fiber release exists.

#### REFERENCE

1. USEPA, Asbestos-Containing Materials in Schools; Final Rule and Notice. Fed. Reg. 40 CFR Part 763. October 30, 1987 p. 41829.

## **Appendix B**

**Testimony in Deposition and Trial by James R. Millette, Ph.D.**

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## Appendix C

Compensation for James R. Millette is paid to MVA Scientific Consultants at the rate of \$300 per hour for research and consulting (the same rate as is charged other non-litigation clients) and \$400 per hour for testimony either by deposition or at trial.